

The Systematics of Korean Carposinidae (Lepidoptera)

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Abstract Five species belonging to three genera of Carposinidae are recognized, and their wing patterns and male and female genitalic structures are redescribed with known distributions and biologies. A genus, *Meridarchis*, and two species, *M. excisa* and *M. jumboa* are reported for the first time from Korea. *Carposina niponensis* and *Commataarcha palaeosema* are misidentifications of *Carposina sasakii* and *Commataarcha vaga*, respectively. The neotype of *Carposina coreana* Kim is designated with the specimen collected from the type locality.

Key words systematics, Lepidoptera, Carposinidae, *Carposina*, *Commataarcha*, *Meridarchis*, *Carposina coreana*, neotype designation, Korea

INTRODUCTION

The family Carposinidae in Korea is a small group that includes only five species belonging to three genera. Although its proper place in the systematics of Lepidoptera is not quite concluded yet, its species can be recognized easily at a glance.

Adult moths usually have raised scale-tufts along outer edge of basal patch and around cell, or rather large species with long wings, whitish, marked with dark dots. They have subtriangular basal patch and costal patch, and their wing venations are much variable interspecifically. They show sexual dimorphism on antennae and labial palpi: females have shorter cilia on antennae, and more elongate and porrect palpi than males. Males also have one frenulum while females have two frenuli.

Their biologies are unknown for most species. Larvae of two species feed on fruits of orchard trees; *Carposina sasakii* is a pest of apple, peach, pear, and other fruits, and *Carposina coreana* infests Japanese cornelian cherry (=sansuyu) (Kim, 1955; Ko, 1969; Yoon, 1972; Yang, 1982.)

In general, species are not difficult to identify but historically have been confused and often misidentified. Diakonoff (1989) recently revised the Palearctic Carposinidae and resolved most of the nomenclatorial problems. In the present paper, the family Carposinidae in Korea is reviewed and the redescriptions of all five species are provided.

HISTORICAL REVIEW

The first genus described, *Carposina* had been placed in several different families by different

authors : in Tineidae, in Gelechiidae, and in Tortricina until Walsingham placed it into Carposinae as a subfamily of Tortricidae in 1897. The family Carposinidae, after Walsingham finally erected it as a separate family in 1907, has been placed in several different superfamilies by many authors: in Copromorphae by Meyrick (1928), in Carposinoidea by Swatschek in 1958, in Alucitoidea by Zimmerman (1978), and in Pyraloidea by Kuznetsov and Stekolnikov in 1979 (Diakonoff, 1989). Diakonoff (1989) finally assigned Carposinidae to the superfamily Pyraloidea, closer to the Alucitidae than to the Pterophoridae.

The first record of carposinids in Korea is *Carposina sasakii*, a pest of peach, by Nakayama (1922). As it is known to be a pest of many fruit trees, *C. sasakii* has been studied on its biology for several decades usually in Japan, China, and Korea. But *C. sasakii* has long been known as *C. niponensis* until Diakonoff (1989) found they are different species from each other through the recent examination of type specimens.

In 1955, Kim reported a new species, *Carposina coreana*, of which the larvae bore into the fruits of *Cornus officinalis*, from Yeosu, central part of Korea, and Yoon (1972) studied its bionomics and control methods according as its damage increased. Unfortunately, *C. coreana* has been excluded in Korean literatures after Yoon mainly because its type specimens were not found. Instead, *Commataarcha palaeosema* was newly reported, and redescribed with *Carposina sasakii* with the name of *C. niponensis* (Park, 1983a, b). But *Commataarcha palaeosema* is also found to be a misidentification of *Commataarcha vaga* that was reported as a new species by Diakonoff (1989).

Thus, including two species and one genus reported here for the first time from Korea, a total of five species belonging to three genera is recognized in Korean Carposinidae as follows:

Carposinidae Walsingham, 1897
Carposina Herrich-Schaffer, 1853
 coreana Kim, 1955
 sasakii Matsumura, 1900
Commataarcha Meyrick, 1935
 vaga Diakonoff, 1989
Meridarchis Zeller, 1867
 excisa (Walsingham, 1900)
 jumboa Kawabe, 1980

KEYS TO THE KOREAN SPECIES OF THE FAMILY CARPOSINIDAE

WING

1. Ground color blackish *Commataarcha vaga*
 Ground color not blackish, rather whitish or brownish 2
2. On the whole, brownish *Carposina sasakii*
 On the whole, not brownish, rather whitish or light greyish 3
3. Median fascia with bat-shaped black transverse bar *Meridarchis excisa*

- Median fascia without black bar 4
4. With conspicuous triangular costal patch; forewing length at least 20 mm *Meridarchis jumboa*
- Without conspicuous triangular costal patch; forewing length at most 19 mm ... *Carposina coreana*

MALE GENITALIA

1. Gnathos arms slender, elongated dorsally 2
- Gnathos arms not as above 3
2. Apex of gnathos arm acuminate; cucullus with long dorsal spine-like projection
..... *Carposina coreana*
- Apex of gnathos arm not acuminate but with spiniform scales; cucullus without long projection
..... *Carposina sasakii*
3. Gnathos expanded and modified as ovidal body; cucullus simple 4
- Gnathos not developed; cucullus three-forked apically *Cammatarcha vaga*
4. Left ovoidal body larger than right one; saccus without long projection ventrally
..... *Meridarchis excisa*
- Left ovoidal body almost same as right one in size; saccus with long projection ventrally
..... *Meridarchis jumboa*

FEMALE GENITALIA

1. Antrum with conspicuous longitudinal wrinkles *Commataarcha vaga*
- Antrum without conspicuous longitudinal wrinkles 2
2. Ostium with a tongue-shaped lobe on the right inside *Meridarchis jumboa*
- Ostium without a lobe 3
3. Ductus bursae internally with longitudinal streaks of papillae 4
- Ductus bursae without streaks of papillae *Meridarchis excisa*
4. Lamella postvaginalis with a longitudinal median lobe *Carposina sasakii*
- Lamella postvaginalis without a median lobe *Carposina coreana*

DESCRIPTION

Family Carposinidae Walsingham

Carposinae Walsingham, 1897, Trans. ent. Soc. London, 1897: 59, as subfam. nov..

Carposinidae Walsingham, 1907, Fauna Hawaiiensis, 1(5): 469.

Genus *Carposina* Herrich-Schaffer

Carposina Herrich-Schaffer, 1853, Systematische Bearbeitung der Schmetterlinge von Europa, zugleich als Text, Revision und Supplement zu J. Hübners Sammlung europäischer

Schmetterlinge, 5: 38.

Asiacarposina Yang, 1982, Entomotaxonomia, IV(4): 253, syn. nov..

***Carposina coreana* Kim 산수유심식나방 (改稱)**

(Figs. 1, 6, 10)

Corposina coreana Kim, 1955, J. Biol. Inst., Seoul Natl. Univ., II(1): 83.

Asiacarposina cornusvora Yang, 1982, Entomotaxonomia, IV(4): 253, syn. nov..

Adult. Forewing: Wing expanse: male 13 mm, female 12 mm [male & female 14–19 mm, respectively, reported by Yang (1982)]; ground color light greyish white with some greyish brown scales scattered overall; basal patch subtriangular, greyish brown, outer margin almost straight; costa with four to five indistinct greyish brown markings; costal patch slightly variable in shape but sub-triangular, consisting mainly of two dark brown patches, one at apex near middle, the other antero-laterally under third and fourth costal markings; marginal line greyish brown; termen greyish white inwardly, grey outwardly. Hindwing: pale grey, darker outwardly; fringe pale grey. Head: front pale yellowish white, some dark brown laterally; vertex pale yellowish white; labial palpus porrect, longer in female, pale yellowish white, dark brown ventrally and laterally, third segment moderate and light brownish yellow in female, short and yellowish white in male; antennal flagellum pale brownish yellow, moderately ciliate in male, scape pale yellowish white; mouthpart dark greyish brown. Thorax: mesonotum pale yellowish white with light grey dorso-medially and with greyish brown transversely near middle; tegulae pale yellowish white with grey to greyish brown anteriorly and/or medially; sternum shiny white. Leg: white, dark greyish brown medially in foreleg and midleg.

Male genitalia. Tegumen gradually expanded dorsally, with setae laterally and apically, apex slightly convex broadly, lateral margin convex, upper ninth tergal ring round, not angled at middle; uncus reduced, without sclerotized projection, spatulate, with setae; socii absent; gnathos well developed, arms slender, angled upwardly near base and elongated dorsally, nearly equaling length of valva, gradually decreasing its width and acuminate, with a short branch near base toward inner space of tegumen, apex of short branch slightly spatulate, bearing hairs; valva with a stout ampulla arising from near middle, ampulla with some short, stout projections, with spine-like long projection originating from juncture of valva and curved dorso-medially beyond apex of cucullus; cucullus round at base and at apex, broader at base, with dense setae inwardly; sacculus oblong, simple, without setae; transtilla well developed, sclerotized, forming a finger-like flat lobe near juncture of valva, lobe with setal holes apically; juxta short, almost flat basally, slightly furcated, each side convex dorsally and with a blade-like dorsal projection, projection shorter than lobe of transtilla; saccus expanded and pointed ventrally at middle, forming almost an equilateral triangle; aedeagus expanded at apical third and with a dense patch of spines, internal tract comes out from near apical third, with two rows of short spines.

Female genitalia. Tergum VIII round laterally, sternum VIII rather long, subtrapezoidal in shape, lateral sides straight; sternum VII moderately sclerotized, folded posteriorly; lamella post-

vaginalis broadly oblong, posterior apophysis about 2.0 times as long as anterior apophysis; ostium broad, reticulate; antrum simple, oblong, reticulate, slightly curved to the right near anterior end, remainder of ductus bursae narrow, with two longitudinal streaks of papillae, ending at corpus bursae, streaks wider near corpus bursae; corpus bursae enlarged abruptly, oval in shape, with two strongly furcate signa posteriorly, each branch of signum a long, flat, and curved hook, serrate on one side following inner curvature.

Larva. Mature larva yellowish, about 10 mm in length; head light yellowish brown with dark brown mouthparts and eyes (Kim, 1955).

Pupa. About 6 mm in length; pupating larva yellowish white, and darker and eyes reddish brown before emerging (Kim, 1955).

Type. Neotype: female. Type locality: Ipo-ri, [Yeoju-gun], GG, KOREA, N37° 23', E127° 32', 20. VIII. 1990 (Soowon Cho); genit. & abd. sl. #: 3020 F [female]; deposited in the Center for Insect Systematics (CIS), Kangweon National University, Chuncheon, Korea.

Material examined. 1 male & 1 female(neotype), same data as neotype; gen. slide no. 3019 M & 3020 F.

Distribution. China, Korea.

Host. *Cornus officinalis* Sieb. et Zucc.

Discussion. The life history studied by Kim (1955) and the bionomics and control methods studied by Yoon (1972) may be cited here in full:

"It seems to deposit one egg in or on fruit. The hatching larva lives in the fruit to grow 10 mm long until October, escaping from it to bore a hole, diam. 1 mm., on the fruits and then forms a first cocoon like disk-diam. 3 or 3.5 mm., thickness about 2 mm--about 15-20 cm deep in the ground to pass the winter in the larval stage (Fig. 3). Next year before pupating the overwintered larva opens it's cocoon in July and drags itself to the surface of the ground and spins the secondary cocoon which is fusiform 6.5 mm in length (Fig. 4), then it pupates and the pupa is about 6 mm long and takes on a darker color when the moth is ready to emerge, though at first whitish. The adult moth emerges about in the middle of August. The pests kept in the Entomological Laboratory of Forest Experiment Station, Seoul, Korea during the winter in 1947 were just beginning to emerge on 11th August, 1948."

"The results which were studied and investigated for *Carposina coreana* conducted during 1971. 5-1972. 3, were summarized as follows:

1. The extent that *Carposina coreana* overwinters herself underground, is at around 4 to 16 cm depth, but most of the larva does at 10 cm depth.
2. The maximum occurrence period of adult is around August 25th, and occasionally it occurs up to September 20th.
3. In case of comparing the damaged part of fruit, the shoulder part is damaged seriously (16.6 %), and on the other hand, the base of fruit haft and the low part of fruit are slight.
4. The ratio of the damaged fruit after September 7th is suddenly increased to 60%. The maximum number of insect which hides herself in one fruit is 3 heads.
5. The degree of fruit damage is different according to the lay of land; mountainous district is

more serious than in the plain or river district. The damage ratio of fallen fruit is around 30%.

6. In the soaking experiment for the insecticidal effectiveness, Birlane, EPN, Sevinx EPN Dimcron and Lebaycid are considered to be very effective over 88%, and only Malathion was less effective than the other.

7. The effective insecticides in the field experiment are Birlana, EPN, Endrin, Lebaycid and Phosved, which are over 80% effectively. The optimum spraying period was during August 24 to 31.

8. A parasite fly and a kind of fungus which parasite to larva were collected, but the ratio of parasite fly is on the degree of 0.5% only".

After this species was described as new, it has been cited in several leading books and journal (Ko, 1969; Yoon, 1972; The Korean Society of Plant Protection, 1972), but when Yang (1982) described *Asiacarposina cornusvora* as new based on the specimens collected from *Cornus officinalis* in China, he did not study any Korean materials. He also described a new genus, *Asiacarposina* based on the wing venations of *A. cornusvora* and *C. niponensis* (= *C. sasakii*), but the genus consequently would be a synonym of *Carposina* because the wing venation in Carposinidae is such a variant interspecifically (Davis, 1969; Diakonoff, 1989) and because he did not use the genitalic characters which are known to be best fitted into their classification (Diakonoff, 1989), Diakonoff (1989) also did not include this species in his revision of the Palaearctic Carposinidae. Because Kim and Yoon described above, this pest occurring at Yeosu, Gyeonggi Province and Gurye, Jeonnam Province were very troublesome. As Kim did not designate the holotype of this species and no further specimens of syntypes has been found in the original collection for some reason or other, the authors hereby designate the neotype with the specimen collected from Ipo-ri, Yeosu-gun, Gyeonggi Province, Korea, which is the same type locality.

***Carposina sasakii* Matsumura** 복숭아심식나방

(Fig. 2, 7, 11)

Carposina sasakii Matsumura, 1900, Ent. Nachrichten, 26 (13-14): 198.

Carpocapsa [sic.] *persicana* Sasaki, 1905, Injurious insects of fruit trees (= Kaju Gaichu Hen), p. 32.

Carposina niponensis auct. (not Walsingham, 1900), misidentification.

Carposina niponensis [sic.]; Park, 1983, Ins. Koreana, Ser. 3: 93, misidentification.

Carposina sasakii: Diakonoff, 1989, Zoologische Verhandlungen, 251 (1989): 67.

Adult. Forewing: Wing expanse: male 13-17 mm, female 14-20 mm; ground color pale brownish yellow or pale yellow; apex not pointed, termen slightly curved outwardly; basal fascia dark greyish brown, outer margin almost straight from about 1/6 of costa to near base, forming subtriangular patch; costa dark greyish brown suffused with greyish yellow spots; costal patch variable in shape but somewhat subtriangular, dark brown with light brown, paler outwardly near costa and inwardly near middle, inconspicuous brown or greyish brown line from lower angle to about 2/3 of dorsum; submarginal line greyish brown to brown, often inconspicuous; marginal line dark brown; termen grey, inner row of scales darker than outer row, scales of inner row pale yellowish grey

basally. Hindwing: grey to dark grey; fringe light grey, inner row of scales light grey, darker than outer row, scales of inner row pale yellowish grey basally. Head: front light greyish brown, sometimes much darker; vertex greyish brown, to pale greyish brown; labial palpus greyish yellow to grey medially, greyish brown to dark brown laterally, dorsal scales of third segment in female elongate basally, ventral scales of third segment in male dark brown and elongate apically; antennal flagellum greyish yellow and moderately ciliate in male, brownish yellow in female, scape dark brown medially, light greyish brown laterally; proboscis greyish yellow. Thorax: mesonotum brown to blackish brown; tegulae greyish brown with dark greyish brown to blackish brown anteriorly; sternum shiny light brownish white. Leg: greyish brown mixed with white, darker in fore-leg and paler in hind-leg.

Male genitalia. Tegumen on the whole subtrapezoidal in shape, with setae laterally and apically, apex slightly concave broadly or almost straight, lateral margin slightly convex, upper ninth tergal ring almost straight, angled at middle; uncus reduced, without sclerotized projection, spatulate, with dense setae; socii absent; gnathos well developed, arms slender, angled upwardly near base and elongated dorsally, nearly equaling length of cucullus, with dense setae at base, with apex slightly swollen and bearing a dense cluster of spiniform scales arising from an apical pit; valva with a stout, claw-like ampulla arising from near apex of sacculus; cucullus crescent, broad at base, tapering to an acute and pointed apex, with dense setae ventrally; transtilla weakly developed, lateral sides sclerotized, forming a finger-like flat lobe near juncture of valva, lobe with setae apically; juxta short, furcate, expanded from dorso-lateral part to basal area of sacculus; saccus curved outwardly, expanded and pointed dorsally and ventrally at middle; aedeagus apical half expanded and cleaved longitudinally into two parts, one with a dense row of cornuti, the other with two rows of cornuti, internal tract comes out from near middle, with two rows of short cornuti.

Female genitalia. Sternum VIII rather long; ostium and antrum united, very broad, nearly as wide as sternum VII; lamella antevaginalis slightly broader anteriorly, convex medio-posteriorly, with a longitudinal median lobe; posterior apophysis about 1.9 times as long as anterior apophysis; outer edge of ostium sinuate; antrum thickened, broad, papillate, remainder of ductus bursae narrow, with two longitudinal streaks of papillae, ending near corpus bursae; corpus bursae enlarged abruptly, broadly oval in shape, with two strongly furcate signa, each branch of signum long, curved apically, serrate on one side following inner curvature; ductus seminalis incepted between caudal end of ductus bursae and termination of antrum.

Pupa. Summer cocoons are formed mostly near soil surface, while winter ones are mostly found in the depth of 0–4 cm, less in deeper position. The formation of summer cocoon by non-diapause larva is to settle the place while in spinning and crawling on the soil surface. Then by spinning over soil particle of 3×2 cm on the soil surface to form the outer wall. The inside is spinned to be hardened. In this way cocoon formation is completed in 24 hours. The procedure to form winter cocoon by diapause larva is firstly to select the places where larva gets into soil while crawling over the surface. Then larva pushes through the soil to skin body. When a certain depth is reached larva keeps abdomen inside to form a space wide enough for head and tail to touch together. Then spinning starts forming outer wall and inner wall is mostly completed within 24 hours. (Narita, 1986).

Larva. Larvae feed on fruits of apple, peach, pome tree, and some other fruits. They are 12–

15 mm in length, and yellowish white but becoming reddish when escaping out of the fruit (Yasuda, 1973). The growth of head width is in accordance with the Dyar's formula and its growth constant is 1.57. The total larval period when reared is 15–16 days, and both a non-diapause larva and a diapause larva show considerable negative phototropism (Narita, 1986).

Life history. Considerably more eggs were found on hairy quince and peach than on hairless apple and pear. In case of apple, eggs are laid mostly on the hairy basin and cavity rather than the hairless medium portion of fruit. It may be thought that the antennae are the most important receptor causing the tactile sense for oviposition and are mostly affected by the number of hairs on the fruit surface (Hukusima, 1957).

The maximum of adult emergence occurs from 30 minutes to one hour before sunset (Narita, 1986). Around 20°C was the best for adult flying in indoor experiment (Hukusima, 1953).

Type. Lectotype, female (designation error as male), designated by Razowski & Kumata (1985); in Entomological Institute, Hokkaido University (EIHU), Japan.

Material examined. 1 female, I.A.S., Suweon, GG, 28. VII. 1980 (C. G. Yoo); 1 female, I.A.S., Suweon, GG, 29. VII. 1982 (W. S. Cho); 1 female, Suweon, GG, 31. VII. 1973 (K. R. Choe); 1 male, Suweon, GG, 31. VII. 1973 (K. T. Park)–gen. slide no. 3009 M; 1 female, I.A.S., Suweon, GG, 4. VIII. 1980 (C. G. Yoo)–gen. slide no. 3010 F; 1 male, I.A.S., Suweon, GG, 5. VIII. 1975 (K. T. Park); 5 males & 8 females, I.A.S., Suweon, GG, 5. VIII. 1980 (K. R. Choe)–gen. slide no. 3000 M, 3001 F, 3004 M; 1 male, I.A.S., Suweon, GG, 5. VIII. 1980 (C. G. Yoo); 1 male, I.A.S., Suweon, GG, 7. VIII. 1980 (C. G. Yoo)–gen. slide no. 3003 M; 1 male & 1 female, Mt. Sungsan, Seoul, 24. VIII. 1990, N37° 30' 30" E126° 54' 55" (Cho, Soowon); 1 male & 2 females, I.A.S., Suweon, GG, 22. IX. 1980 (K. R. Choe)–gen. slide no. 3002 M.

Distribution. Eastern China and Manchuria, Japan, Korea.

Hosts. Rosaceae: *Malus malus* (Diakonoff, 1989), *Prunus amygdalus* (Narita, 1986), *Prunus ansu* (Ko, 1969), *Crataegus cuneata*, *Cydonia oblonga*, *Malus micromalus*, *Malus pumila*, *Malus toringo*, *Prunus armeniaca*, *Prunus mume*, *Prunus persica*, *Prunus salicina*, *Pyrus sononii*, *Sorbus commixta*; Rhamnaceae: *Zizyphus jujuba* (Hukusima, 1957); Palmaceae: *Phoenix dactylifera* (Narita, 1986).

Discussion. *Carposina sasakii* Matsumura is a notorious common pest of peach, apple, and some other fruits all over the Far East, but has long been known as a synonym of *Carposina niponensis* Walsingham (Issiki, 1958, 1971; Okano, 1959; Liu-Yuqiao, 1981; Park, 1983a, b; Narita, 1986; Kuznetsov, 1986), of which the only specimen known is the type. After Sasaki first reported *Carposina* species with the name of Japanese peach fruit worm in 1889, Matsumura found it belong to *Carposina* and described it as a new species, *Carposina sasakii* in 1990 (Narita, 1986). Meanwhile Walsingham (1900) also described a new species as *Carposina niponensis* of which the wing is almost same as *C. sasakii*. Meyrick (1913) reported these two as separate species, but Issiki in 1950 considered two species are conspecific (Issiki, 1958; Narita 1986). As the two were considered to be the same and the date of publication was "VII. 15, 1990" for *C. niponensis* and "Juli. 1900" for *C. sasakii*, *C. niponensis* has long been known as a valid name for peach fruit moth, and *C. sasakii* as a synonym according to the International Code of Zoological Nomenclature (1985), Article 21, (C). Kuznetsov (1986) also described it as "*C. niponensis* Wlsm. (*sasakii* Mtsm.)", but no one actually look through

their genitalia slides of both types. When Diakonoff (1989) compared two types, he found they are absolutely different in male genitalia, so the species *C. sasakii* regained its original name and *C. niponensis* is just another *Carposina* species.

In the United States and Canada, a closely related species, but distinct by biology, occurs, and Davis (1969) uses the subspecific status for this species, *C. niponensis ottawana* Kearfott, 1907. Although their genitalia are very similar in shape, *C. niponensis ottawana*, correctly *C. sasakii ottawana*, feeds on Cornaceae (*Cornus paniculata* = *C. racemosa*) and Saxifragaceae (*Ribes* sp.), totally different kinds of food.

Carposina sasakii seems to also possess a melanistic form with entirely different superficial appearance, *Carposina viduana* Caraja. Diakonoff (1989) ventured to relegate *C. viduana* to the status of a forma as *Carposina sasakii* forma *viduana* Caradja status nov. because of its genitalic similarity.

Genus *Commataarcha* Meyrick

Commataarcha Meyrick, 1935, Exotic Microlepidoptera, p. 594.

Bondia auct. (not Newman, 1856).

Delarchis Meyrick, 1938, Dt. ent. Z. Iris, 52: 15.

***Commataarcha vaga* Diakonoff** 흰점검은심식나방(新稱)

(Figs. 3, 8, 12)

Commataarcha vaga Diakonoff, 1989. Zool. Verh. 251 (1989): 27.

Adult. Forewing: Wing expanse: male 12–14 mm, female 14–15 mm; ground color dark brownish grey, apex not pointed, basal patch with white marking near medial sixth of costa, edge slightly raised, with two more small white spots near middle; postbasal area with white marking near medial third of costa; median fascia mainly with two short white bars near middle, upper one angled outwardly, usually forming a F- or P-shaped mark on left wing, lower one I-shaped, upper white marking sometimes with another white marking inwardly; postmedian area bronzy; submarginal line dark grey; preapical spot bronzy; marginal line black; termen greyish brown, darker inwardly. Hindwing: grey, darker outwardly, fringe arey. Head: front light greyish brown; vertex greyish brown; labial palpus upcurved, greyish brown with some white medially dark greyish brown laterally, antennal flagellum dark brown in female, much paler and ciliate in male, scape dark brown, sometimes paler in male; proboscis brownish yellow. Thorax: greyish brown to blackish brown; tegulae dark greyish brown or greyish brown; sternum shiny light greyish white to grey. Leg: dark greyish brown with some white, paler in hindleg, midfemur with white, often raised scales near distal end.

Male genitalia. Tegumen on the whole rectangular in shape, with setae laterally, dorsal part expanded posteriorly forming a broad oblong, with seate medially; uncus slightly projected, reonde; transtilla well developed, with dark basal edges, dorsally projected at middle; valva short in length, on the whole oval; cucullus three-forked apically, two upper forks thumb-like and one lower fork narrower, ventral margin of lower one continued to that of sacculus; sacculus simple, short, lower me-

dial ends of sacculi almost joined; juxta ventrally protruded, funnel-shaped, beneath the joint of sacculus; vinculum lengthy, well developed; saccus ventrally projected, slightly spatulate; aedeagus slender with apical third expanded and cleaved into two parts longitudinally, one part with an array of cornuti.

Female genitalia. Tergum VIII with setae posteriorly; segment VII moderately sclerotized, narrowed posteriorly; posterior apophysis about 1.5 times as long as anterior apophysis; ostium somewhat cup-shaped, narrowed posteriorly, splitted ventrally forming two dentitions, folded inwardly and forming a reversed V-shaped, little sclerotized dentition between two dentitions; antrum lengthy, well-sclerotized, with longitudinal wrinkles, curved to the left and anteriorly, gradually narrowed anteriorly; ductus bursae narrow with two, papillate, longitudinal lines, gradually increasing its width; corpus bursae simple, oval, with two parts granulate irregularly near posterior end.

Larva. Unknown.

Type. Holotype: female, in Zoological Laboratory, Meijo University (ZLMU), Japan. Type locality: Japan, Hoshu, Mt. Rokusho-san, Toyota, Aichi-ken. Data: 9. VII. 1977 (Y. Arita); female GS 10812.

Material examined. 1 male, Mt. Daedoon, CN, 18. V. 1990 (K. T. Park)-gen. slide no. 3011 M; 1 male, Mt. Dodram, GG, 19. V. 1990 (K. T. Park); 1 male, Chuncheon, GW, 21. V. 1983 (K. T. Park); 1 male, I.A.S., Suwon, GG, 29. VI. 1976 (C. Y. Whang)-gen. slide, 3005 M; 1 female, Chuncheon, GW, 2. VII. 1989 (K. T. Park et B. K. Byun)-gen. slide. 3013 F; 1 female, Sogumgang, GW, 9. VIII. 1988 (K. T. Park)-gen. slide no. 3008 F.

Distribution. Japan, Korea.

Host. Unknown.

Discussion. This species is one of the smallest of this family in Korea. This is closely allied and externally very similar to *C. palaeosema* Meyrick, but differs by the structure of the ostium. Because it is very similar to the male of *C. palaeosema* in genitalia, they should be studied and compared more in biological as well as morphological aspects in the future. After *C. palaeosema* was described as new genus and species (Meyrick, 1935), all the specimens that have similar wing patterns and genitalic structures have been considered as *C. palaeosema* (Park, 1983). As Diakonoff (1989) found a new species, *C. vaga*, which is very similar to *C. palaeosema*, Korean specimens were revised and found to be *C. vaga*, not *C. palaeosema*.

Genus *Meridarchis* Zeller

Meridarchis Zeller, 1867, Stett. Ent. Ztng., 28: 407.

Autogriphus Walsingham, 1897, Trans. ent. Soc. London, 1897: 59.

Pexinola Hampson, 1900, Catalogue of Lepidoptera Phalaena in the British Museum, Arctiidae (No-lidae, Lithosidae), 2: 79.

Propedesis Walsingham, 1900, Asiatic Tortricidae (contin.), Annls. Mag. Nat. Hist., 7(31): 22.

Tribonica Meyrick, 1905, J. Bombay Nat. Hist. Soc., 16: 589.

***Meridarchis excisa* (Walsingham) 어깨무늬심식나방 (新稱)**

(Figs. 4, 9, 13)

Propedesis excisa Walsingham, 1900, Asiatic Tortricidae (contin.), Annls. Mag. Nat. Hist., 7(31): 123.*Meridarchis excisa*: Meyrick, 1913, Lepidopterorum Catalogus, Pars 13: 4.

Adult. Forewing: Wing expanse: male 17–20 mm, female 17–21 mm; ground color white, apex pointed, lateral side of wing slightly concave near apex; basal fascia with blackish brown subtriangular patch on costa, lateral margin straight and slightly projected outwardly near middle; sub-basal fascia with a greyish brown bar raised between middle and inner margin; costal patch inconspicuous, forming a subtriangle with more than seven black spots in three longitudinal rows, four costal, three median, and one lower spot in apex of triangle, inner first costal spot larger than others, inner first median spot often with two more spots nearby, third median spot and lower spot large and connected to form a straight bar, lower spot with short black dash-mark postero-laterally, the bar extending medially with dark brownish grey suffusion, forming a subtriangular blotch near center of a wing; post median area often suffused with greyish brown, white near median straight bar; pre-apical spot with greyish brown inconspicuous line from near apex to near tornus; marginal line with about five dark brown dots along termen; termen outer row of scales light grey, inner row of scales grey or brownish grey, scales of inner row darker outwardly. Hindwing: pointed at apex, concave under apex, light grey to grey, darker marginally and laterally; fringe grey, outer half paler. Head: front white; vertex white; labial palpus porrect, longer in female, white dorso-medially, dark brown ventro-laterally, third segment dark brown basally; antennal flagellum greyish brown, dark greyish brown alternately mixed with white basally in female, much paler and strongly ciliate in male, scape white, sometimes mixed with some light greyish brown; proboscis brownish yellow. Thorax: mesonotum yellowish grey centrally, white marginally; tegulae white with some brown to dark brown anteriorly; sternum shiny white. Leg: white mixed with greyish brown, darker in fore-leg and paler in hindleg, midfemur with white, often raised scales near distal end.

Male genitalia. Tegumen well developed from near middle of ninth tergal ring, on the whole subtrapezoidal in shape, dorsal half with setae, dorsal margin straight, forming a band without setae, sides curved mesad, dorsal half of ninth tergal ring almost straight and angled at middle; uncus well projected, long and narrow, slightly curved posteriorly, with some setae; gnathos modified as sclerotic, ovoidal body with upper part extended in a sclerotic tube, tube slightly tortuous, with cuspidal end, left body larger with lower part papillate and with inner membranous sac, right body only half of dorsal part present, without inner sac; valva long and narrow, apical half slightly curved inwardly, basal half dilated, covered with setae except dorsal inner surface of sacculus and near vinculum, setae thicken apically; vinculum V-shaped, moderate and long, saccus oval, pointed ventrally, vinculum joined dorso-laterally; juxta simple and short, V-shaped; aedeagus thin and long, apical third expanded with clavus, left side with a bunch of long, spinulate, deciduous cornuti, right side with a strong pecten of moderate bristles, apex with two to four long and strong bristles (3n).

Female genitalia. Sternum VIII subconical in shape, moderately sclerotized, extended dorso-

anteriorly, lateral margin round; sternum VII moderately sclerotized, weaker than sternum VIII, folded posteriorly forming lamella antevaginalis with surface punctulate; posterior apophysis about 1.7 times as long as anterior apophysis; ostium very wide, membranous; antrum well developed, posterior half reticulate, anterior half densely papillate, folded diagonally towards left, then curved anteriorly forming ductus bursae, anterior margin of antrum simple and membranous; ductus bursae very long, longer than ostium and antrum together; corpus bursae gradually expanded anteriorly, ovoidal in shape, with two short signa anteriorly, one three-forked, the other two-forked, base of signum round, each branch of signum flat and serrate on one side.

Larva. Unknown.

Type. Holotype: female, in the Natural History Museum(=BMNH), England. Type locality: Japan, Pryer. Data: 1886; BM Genitalia Slide, female 23594.

Material examined. 1 male, I.A.S., Jiam-ri, Chunsung, GW, 9. V. 1989 (K. T. Park)-gen. slide no. 3007 M; 4 males & 8 females, Mt. Daedoon, CN, 18. V. 1990 (K. T. Park)-gen. slide no. 3012 F, 3014 F, 3015 M; 1 male, Mt. Dodram, GG, 19. V. 1990 (K. T. Park); 1 male, Mt. Samag, GW, 22. V. 1990 (K. T. Park)-gen. slide no. 3016 M; 1 male, I.A.S., Mt. Suri, GG; 23. V. 1981 (K. T. Park); 1 male & 1 female, I.A.S., Yangyang, GW, 30. V. 1987 (K. T. Park)-gen. slide no. 3017 F; 1 female, Mt. Odae, GW, 26. VI. 1980 (K. T. Park)-gen. slide no. 3018 F.

Distribution. Japan, Korea, USSR: S Maritime District.

Host. Unknown.

Discussion. Most of species have been collected in May, 1990. Their black marking is often very weak, almost light brown, but the genitalic structure does not show any difference among the specimens.

***Meridarchis jumboa* Kawabe** 삼각무늬심식나방 (新稱)

(Figs. 5, 14)

Meridarchis jumboa Kawabe, 1980, Tinea, 11(3): 29.

Meridarchis jamboa [sic.]; Diakonoff, 1989, Zoologische Verhandelingen, 251 (1989): 92.

Adult. Forewing: Wing expanse: female 20 mm [male 21 mm, female 24 mm, respectively, reported by Diakonoff (1989)]; ground color white to pale brownish white, with some light purplish brown scales scattered; apex pointed; lateral side of wing slightly concave near apex; basal fascia with greyish brown subtriangular patch on costa, patch with dark brown marginal spots; subbasal fascia with a greyish brown spot raised between middle and dorsum; costal patch subtriangular, greyish brown, with ten spots arranged in three longitudinal rows, five upper costal, inconspicuous brown-spots, four median, conspicuous dark brown spots, and one lower, conspicuous dark brown spot in apex of triangle, dark brown scales scattered between median and lower spots; preapical spot greyish brown abruptly widened near costa, angled near inner third toward tornus; marginal line greyish brown to brown; termen outer half pale greyish white, inner half light greyish brown. Hindwing: pointed at apex, concave under apex; pale greyish white, light greyish brown marginally; fringe

white, inner half darker than outer half. Head: frong white with some brown-tipped scales; vertex white; labial palpus porrect, white with some brown-tipped scales medially, brown with mostly brown-tipped scales laterally; antennal flagellum brownish yellow, brown alternately mixed with white basally in female, scape yellowish white; proboscis brownish yellow. Thorax: mesonotum light grey with some brown; tegulae white with some brown anteriorly; sternum shiny white with some brown. Leg: Yellowish grey with some white, paler in hind-leg, mid-femur with white raised scales near distal end.

Female genitalia. Tergum VIII subconical in shape, sclerotized, extended dorso-anteriorly, larteral margin round; sternum VII wide, submembranous, folding posteriorly; posterior apophysis about 1.8 times as long as anterior apophysis; ostium simple, ring-like, with a tongue-shaped lobe on the right inside; ductus bursae long, compressed, posterior three fourth well sclerotized, darken, folded in zigzags twice, anterior fold bigger than posterior fold, anterior fourth simple, weak; ductus seminalis incepted near anterior fourth of ductus bursae; corpus bursae enlarged, lengthy, asymmetrically narrowed at both ends, with two strongly furcate signa near middle, each branch of signum long, narrow, curved apically, slightly serrate on one side following inner curvature.

Larva. Unknown.

Type. Holotype, male; in A. Kawabe Collection, Japan. Type Locality: Usui-toge, Nagano Pref., Japan. Data: 10 VI 1978 (K. Kudo leg.); GS No. 5229. Paratype: 1 female, Nuruyu, Miyagi Pref., 23 V 1971 (T. Watanabe leg.); 1 female, Kumagane, Miyagi Pref., 29 IV 1966 (T. Watanabe leg.); in A. Kawabe Collection, Japan.

Material examined. 1 female, I.A.S., Yongin, GG, 21. V. 1989 (S. B. Lee)-gen. slide no. 3006 F.

Distribution. Japan, Korea.

Host. Unknown.

Discussion. Only one specimen has been collected from Yongin, GG, in 1989. This is closely related with *M. isodina* Diakonoff (1989), from China, but with very distinct genitalia (Diakonoff, 1989).

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한국산 심식나방과의 분류학적 정리

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금번 조사를 통해 한국산 심식나방과는 3속 5종으로 정리되며, 이 중 *Meridarchis*속의 *M. excisa*와 *M. jumboa*가 한국 미기록종으로 보고된다. 과거에 기록된 *Carposina niponensis* 및 *Commataarcha palaeosema*는 각각 *Carposina sasakii*와 *Commataarcha vaga*의 오동정으로 판명되었으며, 김 (1955)에 의해 신종 기재된 *Carposina coreana*는 그 syntype이 없어 문헌에 기록된 모식산지(type locality)에서 최근 채집된 표본중 암컷 1개체를 neotype으로 지정한다. 이상으로 정리된 한국산 심식나방은 다음과 같다.

Carposinidae Walsingham, 1897 심식나방과

Carposina Herrich-Schaffer, 1853

coreana Kim, 1955 산수유심식나방 (改稱)

sasakii Matsumura, 1900 복숭아심식나방

Commataarcha Meyrick, 1935

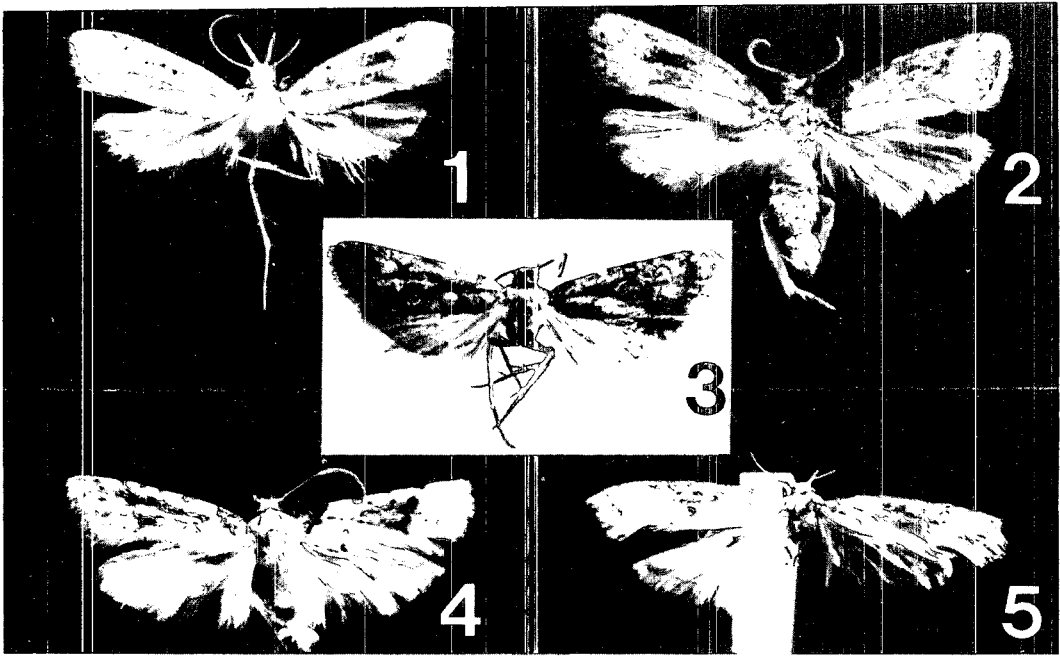
vaga Diakonoff, 1989 흰점검은심식나방 (新稱)

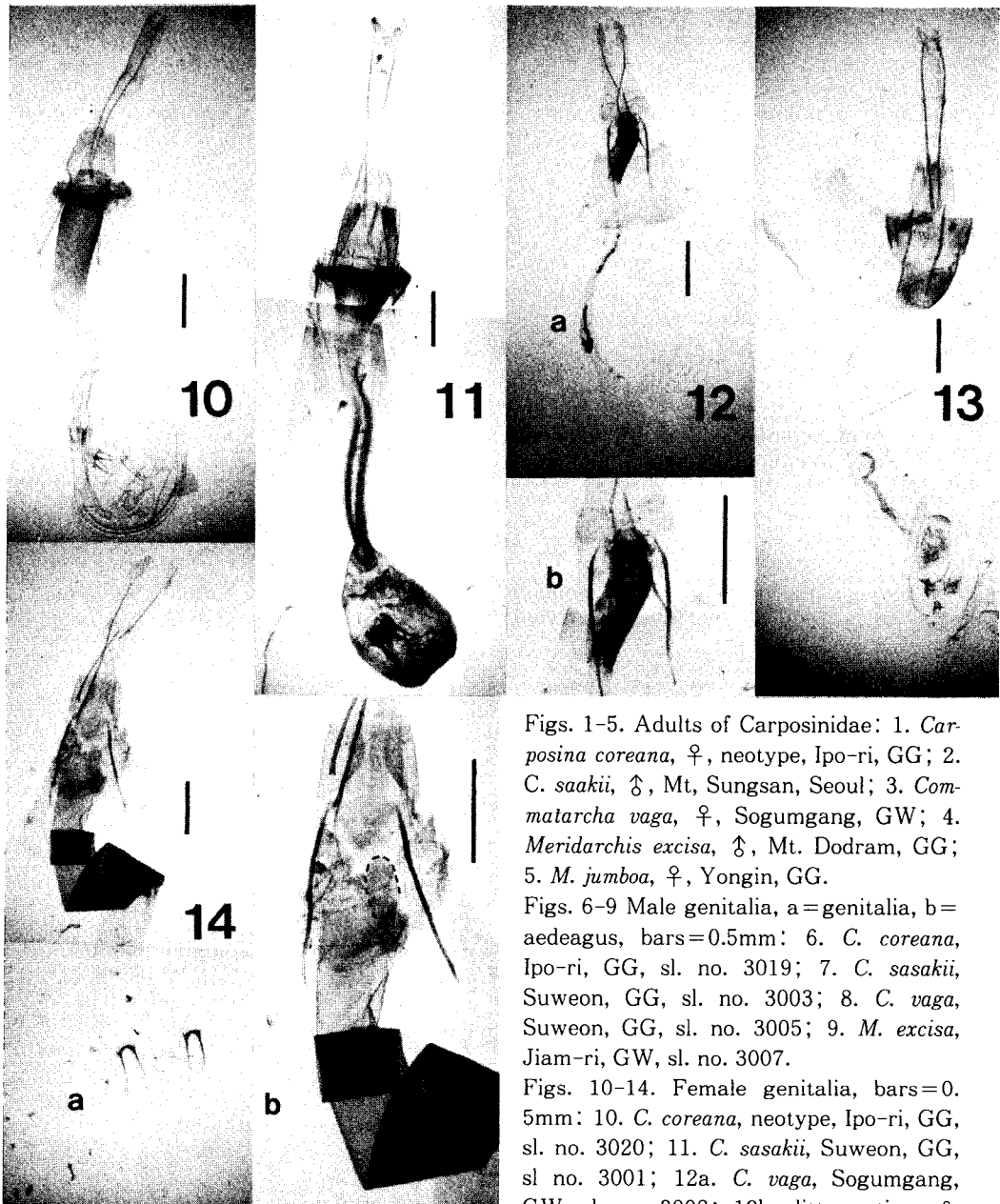
Meridarchis Zeller, 1867

excisa (Walsingham, 1900) 어깨무늬심식나방 (新稱)

jumboa Kawabe, 1980 삼각무늬심식나방 (新稱)

검색어 : 분류, 나비목, 심식나방과, 산수유심식나방, 신모식 선정





Figs. 1-5. Adults of Carposinidae: 1. *Carposina coreana*, ♀, neotype, Ipo-ri, GG; 2. *C. saakii*, ♂, Mt. Sungsan, Seoul; 3. *Commatarcha vaga*, ♀, Sogumgang, GW; 4. *Meridarchis excisa*, ♂, Mt. Dodram, GG; 5. *M. jumboa*, ♀, Yongin, GG.

Figs. 6-9 Male genitalia, a=genitalia, b=aedeagus, bars=0.5mm: 6. *C. coreana*, Ipo-ri, GG, sl. no. 3019; 7. *C. sasakii*, Suweon, GG, sl. no. 3003; 8. *C. vaga*, Suweon, GG, sl. no. 3005; 9. *M. excisa*, Jiam-ri, GW, sl. no. 3007.

Figs. 10-14. Female genitalia, bars=0.5mm: 10. *C. coreana*, neotype, Ipo-ri, GG, sl. no. 3020; 11. *C. sasakii*, Suweon, GG, sl. no. 3001; 12a. *C. vaga*, Sogumgang, GW, sl. no. 3008; 12b. ditto, ostium & antrum part; 13. *M. excisa*, Mt. Odae, GW, sl. no. 3018; 14a. *M. jumboa*, Yongin, GG, sl. no. 3006; 14b. ditto, ostium with tongue-shaped lobe and well-developed ductus bursae.